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**The National Nuclear Energy Series:
An Abridged Compilation**

Nancy P. Orlando-Gay
Technical Library Services

James R. Brangan
Technical Assessment Department

Jonathan Wise
Proliferation Sciences Department

Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185-0899

Abstract

This report is a compilation of the volumes of the National Nuclear Energy Series (NNES). The report consists of: a selection of original prefaces from the NNES, a summary table of all of the NNES volumes, and a large appendix containing the table of contents of each volume.

ACKNOWLEDGEMENTS

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ABOUT THIS COMPILATION

This report is a compilation of the volumes of the National Nuclear Energy Series (NNES). The report consists of: a selection of original prefaces from the NNES, a summary table of all of the NNES volumes, and a large appendix containing the table of contents of each volume.

The National Nuclear Energy Series (NNES) was originally planned in 1945 as a means for obtaining a comprehensive formal record of the results of research and development programs and resulting scientific and technical advances that were accomplished by the Manhattan District. It was also visualized as a continuing program to record the results of the work of the Project when the Atomic Energy Commission assumed control. The NNES preface and the Introductory Note to NNES Division IV provide considerable historical insight into the intent of the series, and are reproduced in this report.

Perhaps the most interesting information in the NNES is that discussing early work in uranium enrichment and reactor theory. Many volumes on these subjects are of an engineering nature, providing significant theoretical and practical details. Most of these volumes were originally classified. Some, notably those discussing electromagnetic isotope separation, have since been declassified; others, mainly those discussing gaseous diffusion, remain classified at the date of this report.

The Introduction to the NNES, which appears in each NNES volume and is reproduced in this report, states that the NNES was expected to consist of approximately 100 volumes when completed, but none of the individual NNES volumes list these 100 volumes. Because of the unique and historic nature of the information in the NNES and its relevance to nuclear proliferation, we believed that it would be useful to the community to identify and catalog all volumes of the NNES.

The unclassified NNES volumes are well known in the open literature. Indeed, MIMC (then a division of Pergamon Press) has made the unclassified volumes available on microfilm. (The Kansas State University Library, Manhattan KS, has a complete set of these films.)

The classified (as well as the unclassified) NNES volumes are catalogued in USAEC Report TID-373, which is a largely accurate representation of the final status of the NNES. However, TID-373 lists proposed volumes that were never actually written, and there a small number of volumes that were later written but are not listed in TID-373 because they had not yet been proposed. Additionally, both TID-373 and the preface to NNES Division IV imply that the Los Alamos Technical Series (LATS) was intended to become NNES Division V. However, for security (classification) reasons, the LATS is not catalogued in TID-373.

As a result of this research, we identified 62 unclassified volumes, 17 classified volumes, and 21 volumes that were proposed but apparently never written. There are an additional 14 classified volumes in the LATS. Of the 21 unwritten volumes, some were intended to be compilations of individual papers, and sufficient proposed table-of-contents information exists for five of those volumes that they could be compiled.

Appendix F of this report reproduces the unclassified and OOU tables of contents of the NNEs volumes. It is because of the omission of classified information that this volume is entitled AN ABRIDGED COMPILATION. A classified companion report to this report includes the classified titles and tables of contents.

REFERENCES

Outline of Volumes in the National Nuclear Energy Series, Technical Information Service, Oak Ridge, TN, report TID-373 (Jan. 1953) (S).

Outline of Volumes in the National Nuclear Energy Series, Technical Information Service, Oak Ridge, TN, report TID-373 (Suppl.) (Jan. 1953) (S). This report includes only the classified titles and tables of contents of NNEs, division II.

NNEs Published Declassified Volumes, Technical Information Service, Oak Ridge, TN, report TID-5103 (1953) (U). This volume is a subset of TID-373.

Edward F. Hammel, Documents and Related Materials Associated with the Contents and the Origin of the Los Alamos Technical Series, Los Alamos National Laboratory, report LA-13100-H (April 1996), and references therein.

Nancy P. Orlando, James R. Brangan, and Jonathan Wise, The National Nuclear Energy Series: A Compilation, Sandia National Laboratories, report SAND99-1113 (May 1999) (SRD)

Pergamon Microforms International Marketing Company (MIMC), (Elmsford NY) advertisement. This ad is reproduced in E.F.Hammel, LA-13100-H.

R.E. Zirkle, National Nuclear Energy Series, Division IV: Arrangement of Collected Papers in Radiobiology for Publication, Argonne National Laboratory, report ANL-5003494; AEC report DE85003494 (March 1948). All information in this report is also included in TID-373.

APPENDIX A: NNES Preface

This volume is one of a series which has been prepared as a record of the research work done under the Manhattan Project and the Atomic Energy Commission. The name Manhattan Project was assigned by the Corps of Engineers, War Department, to the far-flung scientific and engineering activities which had as their objective the utilization of atomic energy for military purposes. In the attainment of this objective, there were many developments in scientific and technical fields which were of general interest. The National Nuclear Energy Series (Manhattan Project Technical Section) is a record of these scientific and technical contributions, as well as of the developments in these fields which are being sponsored by the Atomic Energy Commission.

The National Nuclear Energy Series, when completed, is expected to consist of approximately 100 volumes. These will be grouped into ten divisions, as follows:

- Division I - Electromagnetic Separation Project
- Division II - Gaseous Diffusion Project
- Division III - Special Separations Project
- Division IV - Plutonium Project
- Division V - Los Alamos Project
- Division VI - University of Rochester Project
- Division VII - Materials Procurement Project
- Division VIII - Manhattan Project
- Division IX - Thermal Diffusion Project
- Division X - Centrifuge Project

Soon after the close of the war the Manhattan Project was able to give its attention to the preparation of a complete record of the research work accomplished under Project contracts. Writing programs were authorized at all laboratories, with the object of obtaining complete coverage of Project results. Each major installation was requested to designate one or more representatives to make up a committee, which was called first the Manhattan Project Editorial Advisory Board and later simply the Project Editorial Advisory Board. This group was planned to coordinate the writing programs at all installations and to act as an advisory group in all matters affecting the Project-wide writing program.

The names of the Board members and of the installations which they represented are as follows:

Atomic Energy Commission Public and Technical Information Service Technical Information Division, Oak Ridge Extension Office of New York Operations	Alberto F. Thompson Brewer F. Boardman Charles Slessor, J. H. Hayner, W. M. Hearon*
Brookhaven National Laboratory	Richard W. Dodson
Carbide & Carbon Chemicals Corporation (K-25)	R. B. Korsmeyer, W. L. Harwell, D. E. Hull, Ezra Staple
Carbide & Carbon Chemicals Corporation (Y-12)†	Russell Baldock
Clinton Laboratories ‡	J. R. Coe
General Electric Company, Hanford General Electric Company, Knolls Atomic Power Laboratory	T. W. Hauff J. P. Howe
Kellex Corporation	J. F. Hogerton, Jerome Simson, M. Benedict
Los Alamos	R. R. Davis, Ralph Carlisle Smith
National Bureau of Standards	C. J. Rodden
Plutonium Project Argonne National Laboratory Iowa State College Medical Group	R. S. Mulliken, H. D. Young F. H. Spedding R. E. Zirkle
SAM Laboratories §	G. M. Murphy
Stone & Webster Engineering Corporation	B. W. Whitehurst
University of California	R. K. Wakerling, A. Guthrie
University of Rochester	D. R. Charles, M. J. Wantman

* Represented Madison Square Area of the Manhattan District.

† The Y-12 plant at Oak Ridge was operated by Tennessee Eastman Corporation until May 4, 1947, at which time operations were taken over by Carbide & Carbon Chemicals Corporation

‡ Clinton Laboratories was the former name of the Oak Ridge National Laboratory.

§ SAM (Substitute Alloy Materials) was the code name for the laboratories operated by Columbia University in New York under the direction of Dr. H. C. Urey, where much of the experimental work on isotope separation was done. On Feb. 1, 1945, the administration of these laboratories became the responsibility of Carbide & Carbon Chemicals Corporation. Research in progress there was transferred to the K-25 plant at Oak Ridge in June, 1946, and the New York Laboratories were then closed.

Many difficulties were involved in preparing a unified account of Atomic Energy Project work. For example, the Project Editorial Advisory Board was the first committee ever organized with the representatives from every major installation of the Atomic Energy Project. Compartmentation for security was so rigorous during the war that it had been considered necessary to allow a certain amount of duplication of effort rather than to permit unrestricted circulation of research information between certain installations. As a result, the writing programs of different installations inevitably overlapped markedly in many scientific fields. The Editorial Advisory Board has exerted itself to reduce duplication in so far as possible and to eliminate discrepancies in factual data included in the volumes of the NNES. In particular, unified Project-wide volumes have been prepared on Uranium Chemistry and on the Analysis of Project Materials. Nevertheless, the reader will find many instances of differences in results or conclusions on similar subject matter prepared by different authors. This has not seemed wholly undesirable for several reasons. First of all, such divergencies are not unnatural and stimulate investigation. Second, promptness of publication has seemed more important than the removal of all discrepancies. Finally, many Project scientists completed their contributions some time ago and have become engrossed in other activities so that their time has not been available for a detailed review of their work in relation to similar work done at other installations.

The completion of the various individual volumes of the series has also been beset with difficulties. Many of the key authors and editors have had important responsibilities in planning the future of atomic energy research. Under the circumstances, the completion of this technical series has been delayed longer than its editors wished. The volumes are being released in their present form in the interest of presenting the material as promptly as possible to those who can make use of it.

As many as possible of the volumes have been declassified for general distribution. Reproduction of this classified edition has been approved only for limited circulation within the Atomic Energy Project, and circulation of this edition must be closely limited to facilities and personnel definitely associated with work done for the Atomic Energy Commission. The negatives from which the limited edition is prepared will be preserved and will be available for publication of a public edition at such time as such action is determined to be consistent with the national security.

The Editorial Advisory Board

APPENDIX B: NNES Division IV Foreward

Since the discovery of practical means of utilizing the energy of the atomic nucleus, a large and complex atomic energy industry has begun in the United States. As a result of conditions in the world, external to the United States, the requirements of national security have been paramount in our development of this industry thus far. Constant and increasing attention, however, has been given to the problems of economic nuclear power and to the medical and industrial applications of radioactive materials with a view toward "improving the public welfare, increasing the standard of living, strengthening free competition in private enterprise, and promoting world peace." To this end the Atomic Energy Commission has sought the most effective means to accelerate the practical exploitation of nuclear data by American science and industry. The National Nuclear Energy Series is designed to provide for scientists and engineers as comprehensive a source of such data as is possible. The scope of the information presented in these volumes is a measure of American achievements to date in the field of atomic science.

Lewis L. Strauss, Chairman
U.S. Atomic Energy Commission

APPENDIX C: Plutonium Project Record Foreward
(reproduced from NNES - IV - 12)

This report is a technical account of information collected while developing methods for producing plutonium. Some of the information deals directly with nuclear physics and chemistry. Most of it is related rather to technical processes that needed to be performed in preparation for making the plutonium. These publications represent selections from the great mass of current reports, made on the basis of their value to basic science and technology.

The current technical reports, written during the war years, were essential to the active work of the plutonium project. They supplied needed data and calculations to those who were planning the new processes. Selecting from this mass of records the most reliable data and presenting them in a useful form has been an enormous task, for which the writers and editors of these volumes deserve the sincere thanks of their scientific colleagues. Many fields of science and technology will develop more rapidly because of this knowledge.

The efforts of the men who did this research resulted in the successful production of atomic bombs, which shortened the war and saved the lives of many of their comrades. But in the long view of history it is probable that the major human heritage from their work will not be this quick victory. It may not even be the useful applications of atomic energy, which was first presented as a Promethean gift to man. It is not likely that the scientific information in these pages may be the starting point to new reaches of knowledge, which will give to man an understanding that will truly enrich his life

Arthur H. Compton

APPENDIX D: Introductory Note on the Plutonium Project Record
(NNEs Division IV is the Plutonium Project Record)

Organization and Record of the Metallurgical Project. The Plutonium Project Record, which forms Division IV of the National Nuclear Energy Series (NNEs) is the scientific and technical record of the former Metallurgical Project. The project had its origin in work carried on in 1940-1941, mainly at Columbia and Princeton on the development of the chain-reacting pile and at the University of California at Berkeley on the production and chemistry of transuranic elements. In January 1942 this work was concentrated in the newly organized Metallurgical Laboratory at Chicago under the leadership of A. H. Compton. The Metallurgical Project grew out of the Metallurgical Laboratory. The initial objectives of the Metallurgical Laboratory were (1) to develop chain-reacting piles to produce plutonium and (2) to develop fission bombs. Major associated units were organized in 1942 at Iowa State College at Ames, Iowa (chemistry and metallurgy) under F. H. Spedding; at the University of California at Berkeley, Calif. (chemistry) under W. M. Latimer and E. D. Eastman, continuing the previous work there; and at Massachusetts Institute of Technology (metallurgy) under J. Chipman and later M. Cohen. Early in 1943 the work on fission bombs was transferred to an independent project at Los Alamos.

After the successful demonstration of a nuclear chain reaction in the West Stands pile at Chicago in December 1942, the Argonne Laboratory with its experimental pile was built west of Chicago, and the Clinton Laboratories with their pilot-plant pile were built at Oak Ridge, Tenn. - both in 1943. The three major laboratories at Chicago, Argonne, and Clinton, the associated laboratories at Ames, Berkeley, and M.I.T., and some seventy other cooperating groups then constituted the Metallurgical Project, under A. H. Compton as Project Director. Closely cooperating in the transition from laboratory and pilot-plant to large-scale operation was E. I. du Pont de Nemours & Company, which was made responsible for the design and construction of the Clinton pile and for the design, construction, and operation of the Hanford Plutonium Plant. The Project continued as such until June 30, 1945, when it was dissolved.

The Plutonium Project Record (PPR) covers most of the scientific and technical work of the Metallurgical Laboratory and the Metallurgical Project up to the date of the dissolution of the Project, and also the continuation of this work in the successor laboratories up to approximately Jan. 1, 1946 or in some cases to a later date. In addition, the PPR covers in part the pre-1942 work at Columbia, Princeton, and Berkeley. The record of the work directly leading up to the Los Alamos Project, however, is omitted. Nevertheless the PPR and the Los Alamos Technical Series (Division V of the NNEs) cover closely related and in part overlapping subject matter in some of their volumes, particularly in nuclear physics and in chemistry and metallurgy of plutonium.

Important phases of the work of the Metallurgical Project that are not reported in the PPR but will be reported elsewhere in the NNES are as follows: (1) Division VII, the report of the Materials Procurement Project, includes certain early work on process metallurgy. (2) The Division VIII NNES volumes on Analytical Chemistry, which developed from two volumes originally planned as part of the PPR, contain much Metallurgical Project work, including one complete Collected Papers volume. (3) The Division VIII NNES volumes on Uranium Chemistry, which were planned and carried out under the supervision of the PPR editorial group, likewise contain much Metallurgical Project work, including one complete Collected Papers volume.

History and Plan of the Plutonium Project Record. During the war years the scientific and technical work of the Metallurgical Project and its associated laboratories was described currently in a series of reports called the "C reports." The work up to July 1, 1945 was described in some 3,000 reports. After that date the Clinton Laboratories reports became a separate series, but reports of the other units of the former Metallurgical Project continued to be issued as C reports. Most of the C reports were preliminary or semifinal reports. The main consideration during the wartime development was speed of issue and distribution.

As the mass of scientific and technical knowledge obtained on the Project piled up, an increasing need was apparent for its digestion into survey or summary form. In partial answer to this need, an editorial group was set up in the spring of 1943 to organize a Project Handbook. Although never fully completed because of the engrossment of authors in immediately urgent tasks, and because of the transfer of many of them to other sites, enough of the Project Handbook was finished to be of real value.

By the summer of 1944, the Metallurgical Project had largely concluded its major task, that of providing the scientific and pilot-plant know-how for the design of the large-scale Hanford Plutonium Plant. The time seemed ripe to plan a series of volumes in which the Project's fund of accumulated scientific and technical knowledge would be recorded. These would replace the often sketchy and sometimes mutually contradictory C reports and fill many gaps of unwritten knowledge. In the early planning, Laurence L. Quill as Chief of the Editorial Section of the Project Information Division during the summer of 1944, Eugene Rabinowitch, and H. H. Goldsmith made important contributions. After several committee meetings, a plan for the preparation of a Metallurgical Project Record was approved by the Project Director in the fall of 1944. Later, in 1945, the name was changed to Plutonium Project Report or Record (PPR).

When the PPR was organized, rigid compartmentation was still in effect between the Metallurgical Project and the other Manhattan District projects. Members of each project were in general not supposed to know even the major objectives or main outlines of the other projects. The PPR had therefore to be planned as an independent entity. Nevertheless, at its inception the idea was firmly held that later on the Record should become part of a larger series covering the work of all the atomic energy projects. This idea was repeatedly advocated and led in late 1945 to the plan for the

Manhattan Project Technical Series (MPTS), a name which was finally revised to the present designation of National Nuclear Energy Series (NNES).

The general plan of organization of the PPR was that of a series of some twenty Survey volumes, called "A volumes," each documented by a like-numbered Collected Papers volume (or volumes); these were called "B volumes." In general, following somewhat a pattern set by the Project Handbook, a Survey volume was planned for each scientific or technical subject to which the Metallurgical Project had made sufficiently major contributions. Each Survey volume was intended to be a fairly complete review or monograph (or else a collection of review chapters) on the subject field. It was planned to cover work done both within and outside the Metallurgical Project, though with primary emphasis on the former, outside work being included only for the sake of accuracy and completeness.

In contrast to the Survey volumes, each Collected Papers volume was designed to consist of individual papers, mostly from individual laboratories and more or less similar to articles in the scientific journals; they were to include only work done within the Project. In planning the PPR, it was realized that some of the Survey volumes would overlap with possible volumes of other projects, but because of compartmentation restrictions, it was decided to proceed in general with the plan as outlined. An exception was the field of uranium chemistry, where it was obvious that all the major projects were making important contributions. In this field, a Handbook of Uranium Chemistry was planned early in 1944, to be edited and written at the Metallurgical Laboratory at Chicago, but as a cooperative effort of all the projects, and based on a full interchange of information among them. When the Record was organized, this volume was tentatively included as one of the PPR Survey volumes, to be accompanied by a corresponding Collected Papers volume covering Metallurgical Project work only. Later, when the MPTS (now NNES) was organized, these volumes, with the addition of Collected Papers from the other projects, were transferred to the over-all Division (Division VIII) of the technical series. In the field of analytical chemistry, a Survey volume and a Collected Papers volume were planned for the PPR and were well on their way toward completion. When the MPTS was organized, the content of these volumes was pooled with the work of other projects of the Manhattan District to form Survey and Collected Papers volumes of Division VIII of the MPTS. In certain other fields, pooling of material from the different projects was also considered but was felt to involve too large a task of reorganization.

Because of the wide variety of subject matter, the organization of the PPR into Survey volumes, each accompanied by one or more Collected Papers volumes, is not always consistently followed. There are a few Collected Papers volumes without corresponding Survey volumes, and the converse is also true. Furthermore, the form of organization varies considerably from one volume to another because of the varying subject matter and the preferences of the different volume editors and committees.

When the PPR plans were approved toward the end of 1944, the completion deadline for the manuscripts was set for June 30, 1945, the date

of dissolution of the Metallurgical Project. Most of the PPR volumes were organized into three groups: (1) chemistry and metallurgy; (2) physics and related engineering; (3) biology and medicine. The first task was to obtain volume editors and editorial committees for the various volumes, to plan the contents, and to find authors. John C. Warner, as chemistry editor of the PPR and Chief of the Editorial Section of the Project Information Division from December 1944 to June 30, 1945, made decisive contributions to the chemistry and metallurgy volumes and to the general planning of the PPR.

The organization of the volumes on physics and on biology and medicine went more slowly, partly because the subject matter was then less ripe for writing than was that on chemistry and metallurgy, partly because of the demands for continuing research and, in the field of instrumentation, for production of instruments to be used at Los Alamos, Hanford, and other sites. Eugene P. Wigner, Frederick Seitz, and H. H. Goldsmith took an active part in the early organization of the physics volumes. Plans for the volumes on biology and medicine were very effectively organized by Raymond E. Zirkle as PPR editor for these fields, with the backing of Robert S. Stone as Associate Project Director for Health. Hoylande D. Young entered the PPR program as Technical Editor in charge of final editing and processing of manuscripts, and after June 30, 1946, became General Editor.

After the organization of the PPR, steady progress was made in the work of writing and editing, but at a slower pace than was originally hoped. The dissolution of the Project on June 30, 1945, with the readjustments and administrative problems involved in a 50 per cent cut of total personnel; the end of the war after the bomb was dropped in August and the subsequent deep preoccupation and extensive activities of Project personnel in connection with the social and political implications of atomic energy and atomic warfare; new research and planning directed toward the postwar continuation of the atomic energy program; all these slowed the progress of the PPR writing program. During this difficult period, invaluable encouragement and support of the PPR program came from, among others, Norman Hilberry, Associate Director of the Metallurgical Project up to the time of its dissolution, and Farrington Daniels, Director of the Metallurgical Laboratory in 1945-1946.

Meantime, other projects in the Manhattan District group began the preparation of final accounts of their work. In particular, the Los Alamos Technical Series was begun in 1945. Finally, the MPTS (now the NNES) was organized under the Manhattan District Editorial Advisory Board late in 1945. Under the chairmanship of Alberto F. Thompson, as Chief of the Publications Section of the Research Division of the District, this group began the task of coordinating existing writing activities and filling the gaps in these, with the objective of producing a reasonably well-rounded series of volumes covering the work of the entire District. During early 1946, rules for declassification were set up, and the editors of the MPTS volumes faced the difficult task of dividing the subject matter of their volumes into declassifiable parts, publishable immediately, and classified parts, for which publication must be deferred. In June 1947 the completion of the editorial

work of the PPR, as part of the NNES, was taken over by the Technical Information Division of the Atomic Energy Commission, at Oak Ridge, Tenn.

In addition to those named above, many other project members worked together in planning the PPR. After the general plans were made, the actual work of preparing the various volumes was in the hands of the volume editors, volume editorial committees, and authors, as described in the prefaces of the individual volumes.

Robert S. Mulliken
Editor-in-Chief
Plutonium Project Record

APPENDIX E: Summary of National Nuclear Energy Series Volumes

Volume	Title	Authors	Classification Initial/Current	Comments
DIVISION I - ELECTROMAGNETIC SEPARATION PROJECT				
University of California Radiation Laboratory Section. Editor, R.K. Wakerling				
I-1	Vacuum Equipment and Techniques	A. Guthrie R.K. Wakerling	U	Published 1949 (McGraw-Hill).
I-1 Ch. 6	Chapter 6. Operational Techniques	W.E. Bush	S/U	Published 1952 (USAEC). Additional chapter of NNE-1-1. Report BP-45.
I-2	Magnets and Magnetic Measuring Techniques	A. Guthrie R.K. Wakerling	S/U	Published 1949 (USAEC). Report TID-5215.
I-3	Electrical Circuits for Calutrons	R.K. Wakerling A. Guthrie	S/U	Published 1949 (USAEC). Report TID-5216.
I-4	Electromagnetic Separation of Isotopes in Commercial Quantities	R.K. Wakerling A. Guthrie	S/U	Published 1951 (USAEC). Report TID-5217.
I-5	The Characteristics of Electrical Discharges in Magnetic Fields	A. Guthrie R.K. Wakerling	U	Published 1949 (McGraw-Hill).
I-6	Sources and Collectors for Use in Calutrons	R.K. Wakerling A. Guthrie	S/U	Published 1949 (USAEC). Report TID-5218.
Tennessee Eastman Corporation Section. Editors, Russell Baldock and H. Wesley Savage				
I-7	Separation of Isotopes in Calutron Units	H. Wesley Savage	S/U	Published 1951 (USAEC). Report TID-5233.
I-8	Problems of Physics in the Ion Source	Arthur H. Barnes S.M. MacNeille Chauncey Starr	S/U	Published 1951 (USAEC). Report TID-5219.
I-9	High-Voltage Problems	J.D. Trimmer Harry Pearlman	S/U	Published 1951 (USAEC). Report TID-5211.
I-10	Electrical Equipment for Tanks and Magnets	C.R. Baldock E.D. Hudson	S/U	Published 1952 (USEAC). Report TID-5214.
I-11	Vacuum Problems and Techniques	C.E. Normand Frank A. Knox G.W. Monk Alan J. Samuel W.R. Perret	S/U	Published 1950 (USEAC). Report TID-5210.

Volume	Title	Authors	Classification Initial/Current	Comments
I-12	Chemical Processing Equipment: Electromagnetic Separation Process	G.A. Akin H.P. Kackenmaster R.J. Schrader J.W. Strohecker R.E. Tate	S/U	Published 1951 (USEAC). Report TID-5232.
I-13	Determination of the Isotopic Composition of Uranium	A.E. Cameron	S/U	Published 1950 (USEAC). Report TID-5213.
	Stone and Webster Engineering Corporation Section.			
	Editors: B.W. Whitehurst, R.E. Argersinger, C.T. Chave, J. O'R. Coleman, R.L. Geddes, and G.R. Strandberg			
I-14A	General Engineering Development	B.W. Whitehurst	S/U	Unpublished draft 1946 (USEAC).
I-14B	General Engineering Development	B.W. Whitehurst	S/U	Unpublished draft 1946 (USEAC).
I-15A	Vacuum System	B.W. Whitehurst	S/U	Unpublished draft 1946 (USEAC).
I-15B	Chemical Engineering	B.W. Whitehurst	S/U	Unpublished draft 1946 (USEAC).

(b)(2)High

(b)(2)High

Volume	Title	Authors	Classification Initial/Current	Comments
II-16- Appx. C	Appendix C. Absorption of Fluorine and Uranium Hexafluoride by Sodium Carbonate Solutions	G.G. Joris C.D. Compton	S/U	Published 1949 (USAEC). Additional appendix to NNES-II-16. No evidence that Appendices A or B exist.
DIVISION III - SPECIAL SEPARATION PROJECTS				
Editor: George M. Murrinhv				
		(b)(2)High		
III-1	THE THEORY OF ISOTOPE SEPARATIONS Applied to the Large-Scale Production of U ₂₃₅	NATHAN R. CONEN	U	Published 1951 (McGraw-Hill). This volume is an unclassified abridged version of NNES-III-1A.
III-2	Spectroscopic Properties of Uranium Compounds	G.H. Dieke A.B.F. Duncan	U	Published 1949 (McGraw-Hill).
III-3	Chemical Separation of the Uranium Isotopes	Clyde A. Hutchinson, Jr.	S/U	Published 1952 (USAEC). Report TID-5224.
III-4A	Physical Properties and Analysis of Heavy Water	Isidor Kirshenbaum	U	Published 1951 (McGraw-Hill).
III-4B	Utilization of Heavy Water	Isidor Kirshenbaum	S/U	Published 1951 (USAEC). Report TID-5226.
III-4C	Bibliography of Research on Heavy Hydrogen Compounds	Alice H. Kimball	U	Published 1949 (McGraw-Hill).
III-4D	Laboratory Studies for Separation Processes	Maxwell L. Eidinoff George G. Joris Ellison H. Taylor Hugh S. Taylor Harold C. Urey	S/U	Published 1951 (USAEC). Report AECD-4238.
III-4E	Commercial Production of Heavy Water	James O. Maloney Harold S. Ray	S/U	Published 1951 (USAEC).
III-4F	Production of Heavy Water	George M. Murphy Harold C. Urey Isidor Kirshenbaum	U	Published 1955 (McGraw-Hill).

Volume	Title	Authors	Classification Initial/Current	Comments
III-5	Separation of the Boron Isotopes	George M. Murphy	S/U	Published 1952 (USAEC). Report TID-5227.
III-6	Special Separations at the National Bureau of Standards	George M. Murphy Samuel L. Madorsky	S/U	Published 1952 (USAEC).
DIVISION IV - PLUTONIUM PROJECT RECORD				
Editors, Robert S. Mulliken and Hoylande D. Young				
IV-1	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-2A	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-2B	General Nuclear Physics: Collected Papers	G. S. Goldhaber	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published. Gertrude Scharff Goldhaber was affiliated with Brookhaven National Laboratory.
IV-3A	Neutron Diffusion and Pile Theory: File Physics and Design	A. M. Weinberg	S (planned)	Proposed volume; no evidence that it was written or published. Alvin Martin Weinberg was affiliated with Univ. of Chicago.
IV-3B	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-4	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-7	N/A	N/A	N/A	No evidence that this volume was ever proposed.

(b)(2)High

Volume	Title	Authors	Classification Initial/Current	Comments
IV-8	Optical Instrumentation	George S. Monk W.H. McCorkle	U	Published 1954 (McGraw-Hill).
IV-8A-1	Instrumentation for Radiation Detection	Adrian H. Dahl Robert L. Butenhoff	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published.
IV-8A-2	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-8A-3	Mass Spectroscopy	A.J. Dempster	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published.
IV-9	Radiochemical Studies: The Fission Products	Charles D. Coryell Nathan Sugarman	U	Published 1951 as three books (McGraw-Hill).
IV-10	Physico-chemical Effects of High Energy Radiation	M. Burton E. Shapiro	U (planned)	Proposed volume; no evidence that it was written or published. Possible that NNES-IV-10A was intended.
IV-10-paper	The Effect of Radiation on Water and Aqueous Solutions of Inorganic Substances	A.O. Allen	S/U	This paper was intended to be in NNES-IV-10.
IV-11	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-12A	Metallurgy of Uranium and Its Alloys	J.C. Warner	S/U	Published 1953 (USAEC).
IV-12B	Metallurgy of Uranium and Its Alloys: Collected Papers	J.C. Warner	S (planned)	Proposed volume; no evidence that it was written or published.
IV-13	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-14A	The Actinide Elements	Glenn T. Seaborg Joseph J. Katz	U	Published 1954 (McGraw-Hill). Report AECD-2375.

Volume	Title	Authors	Classification Initial/Current	Comments
IV-14B	The Transuranium Elements: Research papers	Glenn T. Seaborg Joseph J. Katz Winston M. Manning	U	Published 1949 as two books (McGraw-Hill).
IV-15A	The Bismuth Phosphate Separation Process: Survey Volume	I. Perlman	S (planned)	Proposed volume; no evidence that it was written or published.
IV-15B	The Bismuth Phosphate Separation Process: Collected Papers	I. Perlman	S (planned)	Proposed volume; no evidence that it was written or published.
IV-16A	Alternate Processes for the Separation of Plutonium	Harrison S. Brown Winston M. Manning	S (planned)	Proposed volume; no evidence that it was written or published.
IV-16B	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-17A	Production and Separation of U ²³³ : Survey	Glenn T. Seaborg Leonard I. Katz	S/U	Published 1951 (USAEC). Report TID-5222.
IV-17B	Production and Separation of U ²³³ : Collected Papers	Leonard I. Katz	S/U	Published 1952 as two books (USAEC). Report TID-5223.
IV-18A	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-18B	Refractories: Collected Papers	J.C. Warner Leo Brewer	U (planned)	Proposed volume; no evidence that it was written or published.
IV-19A	N/A	N/A	N/A	No evidence that this volume was ever proposed.
IV-19B	The Chemistry and Metallurgy of Miscellaneous Materials: Thermodynamics	Lawrence L. Quill	U	Published 1950 (McGraw-Hill).
IV-19B-Revision	The Chemistry and Metallurgy of Miscellaneous Materials: Thermodynamics, Revision.	Leo Brewer	U	Report UCRL-2854 (11/1955) "Heats of Sublimation of the Elements."
IV-19C	The Chemistry and Metallurgy of Miscellaneous Materials	Lawrence L. Quill	U	Published 1955 (McGraw-Hill). Report TID-5212.

Volume	Title	Authors	Classification Initial/Current	Comments
IV-20	Industrial Medicine of the Plutonium Project: Survey and Collected Papers	Robert S. Stone	U	Published 1951 (McGraw-Hill).
IV-21A	N/A	N/A	N/A	Per preface in NNES-IV-20, NNES-IV-22B, and NNES-IV-23, this volume was abandoned.
IV-21B	N/A	N/A	N/A	Per preface in NNES-IV-20, NNES-IV-22B, and NNES-IV-23, this volume was abandoned.
IV-22A	N/A	N/A	N/A	Per preface in NNES-IV-20, NNES-IV-22B, and NNES-IV-23, this volume was abandoned.
IV-22B	Biological Effects of External X and Gamma Radiation: Part I	Raymond E. Zirkle	U	Published 1954 (McGraw-Hill).
IV-22C	Biological Effects of External X and Gamma Radiation: Part II	Raymond E. Zirkle	U	Published 1956 (McGraw-Hill). Report TID-5220.
IV-22D	Biological Effects of Fast and Slow Neutrons	Raymond E. Zirkle Marjory Lawson	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published, but intended TOC information exists.
IV-22E	Biological Effects of External Beta Radiation	Raymond E. Zirkle	U	Published 1951 (McGraw-Hill).
IV-22F	Metabolism and Biological Effects of Internal Emitters	Raymond E. Zirkle Marjory Lawson	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published, but intended TOC information exists.
IV-22G	Metabolism and Biological Effects of Internal Emitters	Raymond E. Zirkle Marjory Lawson	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published, but intended TOC information exists.

Volume	Title	Authors	Classification Initial/Current	Comments
IV-22H	Metabolism and Biological Effects of Internal Emitters	Raymond E. Zirkle Marjory Lawson	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published, but intended TOC information exists.
IV-22I	Histopathology of Irradiation from External and Internal Sources	William Bloom	U	Published 1948 (McGraw-Hill).
IV-23	Toxicology of Uranium: Survey and Collected Papers	A. Tannenbaum	U	Published 1951 (McGraw-Hill).
DIVISION V - LOS ALAMOS PROJECT				
Editors, Robert R. Davis and Ralph Carlisle Smith				
V-1	Electronics: Experimental Techniques	William C. Elmore Matthew Sands	U	Published 1949 (McGraw-Hill). Also published as Los Alamos Technical Series, Vol. 1, Part 1.
V-2	Ionization Chambers and Counters: Experimental Techniques	Bruno B. Rossi Hans H. Staub	U	Published 1949 (McGraw-Hill). Also published as Los Alamos Technical Series, Vol. 1, Part 2.
V-3	Miscellaneous Physical and Chemical Techniques of the Los Alamos Project	Alvin C. Graves Darol K. Froman	U	Published 1952 (McGraw-Hill). Also published as Los Alamos Technical Series, Vol. 1, Part 3.
V-4	Introduction to the Theory of Neutron Diffusion	Kenneth M. Case Frederic de Hoffmann George Placzek	U	Published 1953 (LASL), but not identified as part of NNES. Also published as Los Alamos Technical Series, Vol. 4. Also published as Report LAMD-1273.
DIVISION V - THE LOS ALAMOS TECHNICAL SERIES				
LATS-1	Experimental Techniques	Darol K. Froman	U	Internal report 1949, 1952 (LASL). Also published as NNES-V-1, NNES-V-2, and NNES-V-3.

Volume	Title	Authors	Classification Initial/Current	Comments
LATS-4	Introduction to the Theory of Neutron Diffusion	George Placzek	U	Internal report 1953 (LASL). See also NNES-V-4.

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DIVISION VI - UNIVERSITY OF ROCHESTER PROJECT
Editors, Donald D. Charles and Andrew H. Dowdy

VI-1	Pharmacology and Toxicology of Uranium Compounds	Carl Voegtlin Harold C. Hodge	U	Published 1949 (books 1 & 2) and 1953 (books 3 & 4) (McGraw-Hill).
VI-2	Biological Effects of External Radiation	H.A. Blair	U	Published 1954 (McGraw-Hill).
VI-3	Biological Studies with Polonium, Radium, and Plutonium	Robert M. Fink	U	Published 1950 (McGraw-Hill).

DIVISION VII - MATERIALS PROCUREMENT PROJECT
Editor, Charles Slesser

VII-1	Preparation, Properties, and Technology of Fluorine and Organo Fluoro Compounds	Charles Slesser	U	Published 1951 (McGraw-Hill).
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Volume	Title	Authors	Classification Initial/Current	Comments
VII-2A	Uranium Technology: General Survey	J.E. Vance J.C. Warner	S/U	Published 1951 (USAEC). Report TID-5231.
		(b)(2)High		
VII-3	Polonium	Harvey V. Moyer	U	Published 1956 (USAEC). Pergamon ad identifies this volume as part of NNES. Report TID-5221.
VII-3- Ch. 14	Polonium. Chapter 14. The Production of Polonium	J.W. Wright G.D. Nelson	S/U	Published 1955 (USAEC). Additional chapter of NNES-VII-3. Report TID-5316.
VII-4	The Metallurgy of Zirconium	Benjamin Lustman Frank Kerze, Jr.	U	Published 1955 (McGraw-Hill).
		DIVISION VIII - MANHATTAN PROJECT		
VIII-1	Analytical Chemistry of the Manhattan Project	C.J. Rodden N.H. Furman E.H. Huffman T.D. Price L.L. Quill J.I. Watters	U	Published 1950 (McGraw-Hill).
VIII-1- Ch. 41	Chapter 41. The Analysis of Graphite	G.E. Boyd	S/U	Report TID-5244.
VIII-2	Collected Analytical Papers	C.J. Rodden	U (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published.
VIII-3	N/A	N/A	N/A	No evidence that this volume was ever proposed.
VIII-4	Analytical Chemistry: Collected Papers	C.J. Rodden	S (planned)	Proposed volume. Per note in copy of TID-373 held by DOE historian (Germantown), this volume was not published.

Volume	Title	Authors	Classification Initial/Current	Comments
VIII-5	The Chemistry of Uranium. Part I. The Element, Its Binary and Related Compounds	Joseph J. Katz Eugene Rabinowitch	U	Published 1951 (McGraw-Hill).
VIII-6	Chemistry of Uranium	Joseph J. Katz Eugene Rabinowitch	U (planned)	We suspect that this was intended to be The Chemistry of Uranium. Part II, but there is no evidence that this volume was written.
VIII-6- paper A7	The System Uranium-Nitrogen			Internal report 1946 (USAEC). Pergamon ad lists this as a distinct part of NNES, but it is actually NNES-VIII-7-paper 6.
VIII-7	Chemistry of Uranium: Collected Papers	Joseph J. Katz Eugene Rabinowitch	U	Published 1958 as two books (USAEC). Based on titles listed in TID-373, we conclude that this report was intended to be NNES-VIII-7, Report TID-5290.
VIII-8	Medical Effects of the Atomic Bomb in Japan	Ashley W. Oughterson Shields Warren	U	Published 1956 (McGraw-Hill).
DIVISION IX - THERMAL DIFFUSION PROJECT				
IX-1	Liquid Thermal Diffusion	Philip H. Abelson Nathan Rosen John I. Hoover	S/U	Published 1951 (USAEC). Report TID-5229.
DIVISION X - CENTRIFUGE PROJECT				
X-1	Developments in the Centrifuge Separation Project	J.W. Beams A.C. Hagg E.V. Murphree	S/U	Published 1951 (USAEC). Report TID-5230.



APPENDIX F: NNES Tables of Contents

NNES - I - 1

VACUUM EQUIPMENT AND TECHNIQUES

Edited by A. Guthrie and R. K. Wakerling

Published 1949

McGraw-Hill Book Company, Inc., New York

264 pages plus xvii pages

Chapter 6 published 4/1952 - Secret, declassified 4/1956

33 pages

Chapter		Report No.
1	Fundamental Considerations in Vacuum Practice by R. Loevinger	AECD-1946 (BP-43)
2	Elements of the Vacuum System by W. E. Bush	AECD-2084 (BP-33)
3	Vacuum Gauges by K. M. Simpson	AECD-2186 (BP-34)
4	Vacuum Materials and Equipment by W. E. Bush	AECD-2206 (BP-68)
5	Leak-detection Instruments and Techniques by R. Loevinger and A. Guthrie	AECD-2405 (BP-93)
	Appendix	
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6	Operational Techniques	BP-45

NNES - I - 2

MAGNETS AND MAGNETIC MEASURING TECHNIQUES

Edited by A. Guthrie and R. K. Wakerling

Report Number: TID-5215

Published 1949 - Secret, declassified 4/1955

USAEC Technical Information Service, Oak Ridge

231 pages

Chapter		Report No.
1	Some Basic Considerations Regarding Magnet Design Requirements by Wilson M. Powell and Eneas Kane	BP-51
2	Magnetic Measuring Instruments and Techniques by John DePhanger, R. K. Wakerling, and A. Guthrie	UCRL-24
3	Model Magnets and Their Performance by R. K. Wakerling	BP-108
4	Magnetic Tests on Full-scale Magnets by R. K. Wakerling and A. Guthrie	BP-126
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NNES - I - 3

ELECTRICAL CIRCUITS FOR CALUTRONS

Edited by R. K. Wakerling and A. Guthrie

Report Number: TID-5216

Published 1949 - Secret, declassified 4/1955

USAEC Technical Information Service, Oak Ridge

300 pages

Chapter		Report No.
1	General Theory of Regulator Systems by Burton F. Miller	UCRL-72
2	High-voltage Regulators by K. MacKenzie	UCRL-76
3	Arc Regulation and Temperature Control by R. deLiban	UCRL-170
4	Magnet Regulators by K. MacLeish	UCRL-225
5	Miscellaneous Electrical Circuits by A. Guthrie	UCRL-323
	Index	

NNES - I - 4

ELECTROMAGNETIC SEPARATION OF ISOTOPES IN COMMERCIAL QUANTITIES

Edited by R. K. Wakerling and A. Guthrie

Report Number: TID-5217

Published 1951 - Secret, declassified 5/1955

USAEC Technical Information Service, Oak Ridge

456 pages

Chapter		Report No.
	Introduction by W. E. Parkins	UCRL-838
Part I - The Calutron		
1	Basic Considerations in the Calutron Process by E. Gardner and A. Guthrie	UCRL-825
2	Space-charge Neutralization and Studies of the Beam Plasma by B. Peters, A. C. Helmholz, and W. E. Parkins	UCRL-826
3	Magnetic Linear Shims for Beam Focusing by R. K. Wakerling	UCRL-827
4	Other Magnetic Shimming Devices by R. K. Wakerling	UCRL-828
5	Performance of Magnetic shims and Focal Studies by H. F. Weaver and R. K. Wakerling	UCRL-829
6	Electric Focusing Devices by B. Peters	UCRL-830
7	Focusing Action of Accelerating Electrodes by R. K. Wakerling and A. C. Helmholz	UCRL-831
8	The Alpha 3 and 4 Programs by W. E. Parkins	UCRL-832
Part II - The Isotron		
9	The Isotron by R. R. Wilson	UCRL-833
Part III - Other Electromagnetic Separation Methods		
10	The Ionic Centrifuge by J. Slepian	UCRL-834
11	The Radial Magnetic Separator by E. Gardner	UCRL-835
12	The Resonance Method by J. R. Richardson	UCRL-836
13	The Low-voltage Method - Grid Slit Systems by F. Schmidt	UCRL-837
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NNES - I - 5

THE CHARACTERISTICS OF ELECTRICAL DISCHARGES IN MAGNETIC FIELDS

Edited by A. Guthrie and R. K. Wakerling

Published 1949

McGraw-Hill Book Company, Inc., New York

376 pages plus xviii pages

Chapter		Report No.
1	Qualitative Description of the Arc Plasma in a Magnetic Field by D. Bohm	MDDC-597 (BP-38)
2	The Use of Probes for Plasma Exploration in Strong Magnetic Fields by D. Bohm, E. H. S. Burhop, and H. S. W. Massey	AECD-2230 (BP-46)
3	Minimum Ionic Kinetic Energy for a Stable Sheath by D. Bohm	MDDC-537 (BP-32)
4	Theoretical Considerations Regarding Minimum Pressure for Stable Arc Operations by D. Bohm	MDDC-681 (BP-47)
5	Experimental Investigation of Threshold Pressure for Stable Operation of Arcs by E. H. S. Burhop, H. S. W. Massey, and G. Page	MDDC-636 (BP-30)
6	Measurements of the Absolute Values of the Cross Sections for Ionization of Uranium Tetrachloride and Uranium Hexafluoride by Electrons by W. E. Berkey, E. H. S. Burhop, J. D. Craggs, J. Keene, and H. S. W. Massey	MDDC-564 (BP-26)
7	The Ionization and Dissociation of Uranium Tetrachloride and Uranium Hexafluoride by Electron Impact by E. H. S. Burhop, H. S. W. Massey, and C. Watt	MDDC-1529 (BP-37)
8	The Rate of Ion Production by an Electron Beam by T. L. Hill and L. H. Aller	MDDC-425
9	A Study of the Arc Plasma by D. Bohm, E. H. S. Burhop, H. S. W. Massey, and R. W. Williams	AECD-2094 (BP-39)
10	Discharge Cathodes by W. E. Parkins	MDDC-650 (BP-35)
11	Theory and Operation of a Philips Ionization Gauge Type Discharge by J. Backus	MDDC-1327 (BP-27)
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NNES - I - 6

SOURCES AND COLLECTORS FOR USE IN CALUTRONS

Edited by R. K. Wakerling and A. Guthrie

Report Number: TID-5218

Published 1949 - Secret, declassified 4/1955

USAEC Technical Information Service, Oak Ridge

291 pages plus vii pages

Chapter		Report No.
1	Design Factors with Relation to Ion Theory by A. F. Clark, A. Guthrie, and Byron Wright	UCRL-927
2	Mechanical Design of the Ion Source by W. M. Brobeck, M. Martin, R. Condit, and T. Fahrner	UCRL-928
3	Charge Materials and Operation by E. J. Lofgren, F. H. Schmidt, and A. F. Clark	UCRL-929
4	Full-energy Collectors by E. Gardner, H. York, and William E. Parkins	UCRL-930
5	Deceleration Collectors by William E. Parkins	UCRL-931
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NNES - I - 7

SEPARATION OF ISOTOPES IN CALUTRON UNITS

Edited by H. Wesley Savage

Report Number: TID-5233

Published 1951 - Secret, declassified 2/1960

USAEC Technical Information Service, Oak Ridge

437 pages

Chapter

Report No.

Part I - Introduction
Edited by H. W. Savage

- 1 Electromagnetic Process Plant
by H. W. Savage
- 2 Electromagnetic Plant Specifications
by H. W. Savage
- 3 Production Equipment and Development at CEW-TEC
by A. J. Miller and H. W. Savage

This volume
is made up of
Report H-1.740.1

Part II - Ion Source
Edited by J. S. Hood

- 4 Development of the Beta Ion Source
by John Harding, R. S. Livingston, and E. G. Struxness
- 5 Performance of the Beta Ion Source
by R. S. Livingston, J. E. Rogers, J. Rolland, and E. G. Struxness
- 6 Beta Experimental Sources
by J. Harding, R. S. Livingston, Fred Pressey, and E. G. Struxness
- 7 Alpha I Ion Sources
by J. S. Culver and M. A. Richtmyer
- 8 Alpha II Ion Sources
by F. F. Calloway and P. E. Wilkinson

Part III - Ion Receivers

- 9 Introduction to Ion Receivers
by B. Harmatz and K. Korn
- 10 Alpha I Receivers
by K. Korn and B. L. Moore
- 11 Alpha II Receivers
by C. R. Baldock
- 12 Development of Beta Production Receivers
by R. S. Livingston, B. L. Moore and I. E. Slawson
- 13 Scraper-type Receivers
by R. S. Livingston and B. L. Moore
- 14 Deceleration-type Receivers
by B. L. Moore
- 15 The Receiver Mechanism
by W. O. Brunk and K. Korn

(Continued)

Chapter

Report No.

Part IV - Liners
Edited by J. S. Hood

- 16 Liners
by F. A. Knox

Part V - Stable-Isotope Separation
Edited by C. P. Keim

- 17 Problems in Adapting the Calutron
by Warren Ketler
- 18 Chemistry Related to the Separation of Stable Isotopes
by A. J. Miller and B. S. Weaver
- Bibliography
- Index

NNES - I - 8

PROBLEMS OF PHYSICS IN THE ION SOURCE

By Arthur H. Barnes, S. M. MacNeille, and Chauncey Starr
Edited by H. Wesley Savage

Report Number: TID-5219
Published 1951 - Secret, declassified 5/1955
USAEC Technical Information Service, Oak Ridge
294 pages plus viii pages

Chapter		Report No.
	<i>Part I - Production of Ions in the Calutron</i>	
1	Introduction	This volume is made up of Report H-1.740.2
2	Cathodes and Defining Slots	
3	Production-improvement Studies	
4	Accelerating System and Ion Beams	
	<i>Part II - Vapor Production and Control</i>	
5	Vapor Production	
6	Vapor Control	
7	Vapor-flow Measurement	
8	Problems Associated with Vapor Production	
9	Charge Studies	
10	External Feed Systems	
	<i>Part III - Electron Drain</i>	
11	Nature of Electron Drain	
12	Drain-control Systems	
13	Ceramic Drain Control	
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NNES - I - 9

HIGH-VOLTAGE PROBLEMS

By J. D. Trimmer and Harry Pearlman
Edited by H. Wesley Savage

Report Number: TID-5211
Published 1951 - Secret, declassified 1/1954
USAEC Technical Information Service, Oak Ridge
246 pages

Chapter		Report No.
	<i>Part I - High-Voltage Sparking</i>	
1	Original Equipment in Relation to Sparking	This volume is made up of Report H-1.740.3
2	Extent and Nature of Sparking	
3	Outage and Contamination Due to Sparking	
4	High-voltage Cables and Cable Terminations	
5	High-frequency Transients	
	<i>Part II - High-Voltage Insulators</i>	
6	Introduction and General Description	
7	Conditions of Calutron Insulator Operation	
8	Calutron Insulators in the Plant	
9	Some Engineering Aspects of Calutron Insulators	
10	Research on Factors Affecting Insulator Performance	
11	General Considerations	
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NNES - I - 10

ELECTRICAL EQUIPMENT FOR TANKS AND MAGNETS

Edited by C. R. Baldock and E. D. Hudson

Report Number: TID-5214

Published 1952 - Secret, declassified 6/1955

USAEC Technical Information Service, Oak Ridge

425 pages

Chapter		Report No.
	Part I - High-Voltage Supplies	
	Introduction to Part I	
1	General Description of High-voltage Supplies	This volume is made up of Report H-1.740.4
2	Physical Descriptions and Ratings of High-voltage Supplies	
3	Revisions in Rectifier and Auxiliary Equipment	
4	Equipment Ratings and Operating Requirements	
5	Service Record	
6	High-voltage-rectifier Studies	
7	Decell-supply Electronic Regulator	
8	Changes in Regulators	
9	Electronic Regulators: Service Record, Maintenance, and Studies	
10	Equipment for Personnel Protection	
	Part II - Auxiliary Electrical Equipment	
	Introduction to Part II	
11	Filament-supply Equipment	
12	Arc-supply Equipment	
13	Filament-arc Regulators	
14	Ion-source Heater Supply and Control Equipment	
15	Experimental and Theoretical Studies	
16	Miscellaneous Motor Controls	
17	Ion-beam Monitoring	
	Part III - Magnet Equipment	
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18	Description of Magnet System	
19	Detection and Location of Ground Faults	
20	Direct-current Switchgear and Protective Equipment	
21	Current Monitoring	
22	Current Regulators	
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NNES - I - 11

VACUUM PROBLEMS AND TECHNIQUES

By C. E. Normand, Frank A. Knox, G. W. Monk, Alan J. Samuel, and
W. R. Perret

Report Number: TID-5210
Published 1950 - Secret, declassified 6/1954
USAEC Technical Information Service, Oak Ridge
265 pages plus v pages

Chapter		Report No.
1	Production-plant Vacuum Systems by C. E. Normand	This volume is made up of Report H-1.740.5
2	Materials Used in Vacuum Systems by C. E. Normand	
3	Cold Traps and Refrigerants by C. E. Normand and Frank A. Knox	
4	Vacuum-system Instrumentation by W. R. Perret and G. W. Monk	
5	Vacuum Testing and Leak Detection by G. W. Monk and C. E. Normand	
6	Pump-down and Outgassing by C. E. Normand and Alan J. Samuel	
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	Appendix B	
	Appendix C	
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NNES - I - 12

CHEMICAL PROCESSING EQUIPMENT: ELECTROMAGNETIC SEPARATION
PROCESS

Edited by G. A. Akin, H. P. Kackenmaster, R. J. Schraeder,
J. W. Strohecker, and R. E. Tate

Report Number: TID-5232

Published 1951 - Secret, declassified 2/1960

USAEC Technical Information Service, Oak Ridge

506 pages

Paper	
1	A Description of the Plant for Producing U-235 by the Electromagnetic Process by G. A. Akin
2	The Chemical and Recovery Phases of the Alpha Plant Operations by J. L. Patterson
3	The Recovery of Uranium from Alpha Calutron Wash by R. J. Schmidt
4	The Liquid-phase Chlorination of Uranium Trioxide to Uranium Tetrachloride for the Alpha Electromagnetic Separation Process by F. M. Tench, Jr.
5	The Vapor-phase Chlorination of Uranium Trioxide by F. M. Tench, Jr.
6	Description of Building 9207 Area for Handling Enriched Feed by R. J. Schrader
7	Recovery of Uranium Trioxide from Alpha Gunk Solution and Various Contaminated Materials in Building 9207 by A. DeHaan, Jr. and R. J. Schrader
8	The Preparation of Uranium Tetrachloride from Uranium Trioxide in Building 9207 by H. I. Bernstein and R. J. Schrader
9	The Vacuum-sublimation Process in Building 9210 by J. W. Strohecker
10	Processing of Combustible Salvage Materials in Building 9769 by W. B. Webster and R. J. Schrader
11	Interlocks in the 9207 Area by J. W. Strohecker
12	Control and Neutralization of Phosgene by R. J. Schrader
13	A Description of the Beta Chemical Operations in the Electro- magnetic Separation Plant by H. R. Brigham
14	The Chemical Operations of Cleaning and Recovery in the Beta Recovery Department by T. H. Little

Report No.
This volume
is made up of
Report H-1.740.6

(Continued)

Paper		Report No
15	Methods and Equipment for Cleaning Uranium Compounds from Surfaces by H. W. Winkler	
16	Application of Peroxide Precipitation for the Purification and Recovery of Uranium in the Beta Electromagnetic Separation Plant by J. S. Reece	
17	Concentration Equipment in the Beta Recovery Department by G. Malinoff	
18	Losses in Beta Recycle in the Beta Recovery Department by W. Tames	
19	Conversion of Uranium Hexafluoride to Uranium Trioxide by F. N. Case	
20	Extraction of Uranium from Solutions Containing Various Metallic Impurities by G. A. Akin	
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28	Preparation of Uranium Tetrafluoride from Uranium Peroxide by A. B. Townsend	
29	Salvage Operations in Final Product Preparation by A. B. Townsend	
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DETERMINATION OF THE ISOTOPIC COMPOSITION OF URANIUM

By A. E. CAMERON

Report Number: TID-5213

Published 1950 - Secret, declassified 4/1955

USAEC Technical Information Service, Oak Ridge

192 pages plus xx pages

Chapter		Report No.
	<i>Part I - Mass Spectrometry</i>	
1	Introduction	This volume is made up of Report H-1.740.7
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3	Spectrometer Tube	
4	Electronics and Vacuum System	
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6	Factors Affecting Accuracy	
7	Scanning Methods	
8	Maintenance Methods	
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STONE AND WEBSTER ENGINEERING CORPORATION CONTRIBUTION TO
THE ELECTROMAGNETIC SEPARATION PROJECT, PART I. GENERAL
ENGINEERING DEVELOPMENTS

Chief Editor: B. W. Whitehurst

Edited by: R. E. Argersinger, C. T. Chave, J. O'R. Coleman, R. L. Geddes,
and G. R. Strandberg

Unpublished Draft 10/14/1946 - Secret, declassified (unknown date)
USAEC Technical Information Service, Oak Ridge
537 pages

Chapter		Report No.
I	Initial Activities and General Design - Stone and Webster Engineering Corp.	
	1. Early Project History by A. C. Klein	
	2. Transforming Laboratory Equipment into a War Production Plant by L. O. Waite, J. O'R. Coleman, and J. Thornton	
II	The Magnet Buildings	
	1. The Main Magnets and Their Excitation by J. O'R. Coleman	
	2. Magnet Protection by J. O'R. Coleman	
	3. Calutron Magnet Coils by W. C. Sealey (Allis-Chalmers Mfg. Co.)	
	4. Preliminary Operation at Clinton Engineering Works by F. W. Argue	
III	Process Equipment	
	1. General Principles and Description by R. C. VanSickle (Westinghouse Electric Corporation)	
	2. Design Problems by R. C. VanSickle (Westinghouse Electric Corporation)	
	3. Alternate Designs by R. C. VanSickle (Westinghouse Electric Corporation)	
	4. Manufacturing by R. C. VanSickle (Westinghouse Electric Corporation)	
	5. Heater Research by O. G. Vogel (Edison General Electric Appliance Company)	
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	2. High Voltage Cubicles by E. V. DeBlieux (General Electric Company)	
	3. High Voltage Tubes by General Electric by K. C. DeWalt (General Electric Company)	

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4. High Voltage Tubes by Westinghouse
by H. J. Dailey (Westinghouse Electric Corporation)
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 1. Voltage Divider and Current Standard
by T. A. Rich (General Electric Company)
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by F. E. Crevor (General Electric Company)
 3. Filament Supply and Ionizing Arc Regulators and Heater
Control
by O. W. Livingston (General Electric Company)
- VI Procurement, Inspection, and Expediting of Equipment and
Materials
by W. M. Driscoll, T. J. Forde, J. P. Piper, and
G. P. Darlington

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STONE AND WEBSTER ENGINEERING CORPORATION CONTRIBUTION TO
THE ELECTROMAGNETIC SEPARATION PROJECT, PART II. GENERAL
ENGINEERING DEVELOPMENT

Chief Editor: B. W. Whitehurst

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and G. R. Strandberg

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USAEC Technical Information Service, Oak Ridge

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	by J. A. Hutcheson (Westinghouse Electric Corporation)	
	2. Research on Materials and Processes	
	by W. R. Woodward (Westinghouse Electric Corporation)	
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	by G. W. Dunlap (General Electric Company)	
	4. Process Research	
	by K. H. Kingdon, H. C. Pollock, and L. D. Roberts (General Electric Company)	
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	6. Engineering Service at the Plant Site	
	by J. D. Sharp, Jr. (General Electric Company)	
	7. High Voltage Kerite Cables	
	by Alan Standish Dana (The Kerite Company)	
	8. Design, Production and Termination of Bin Power Supply Cable	
	by E. Richman (General Cable Corporation)	
VIII	Process Cooling System	
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	by B. W. Whitehurst	
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	by Sheppard T. Powell, E. I. Knoedler, Jr., and Sheppard T. Powell, Jr.	
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	by Gustave Lindkvist, Edward J. Burnell (Link-Belt Company)	
	3. Face Plate Handling Trucks for Beta	
	by R. C. VanSickle (Westinghouse Electric Corporation)	
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8. Interlocking
by S. Linton

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STONE AND WEBSTER ENGINEERING CORPORATION CONTRIBUTION TO
THE ELECTROMAGNETIC SEPARATION PROJECT, PART I. VACUUM
SYSTEM

Chief Editor: B. W. Whitehurst

Edited by: R. E. Argersinger, C. T. Chave, J. O'R. Coleman, R. L. Geddes,
and G. R. Strandberg

Unpublished Draft 10/14/1946 - Secret, declassified (unknown date)
USAEC Technical Information Service, Oak Ridge
537 pages

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I	High Vacuum Systems	
	1. Engineering Report on High Vacuum Practice - Y-12 Area by B. W. Whitehurst	
	2. Calculating High Vacuum Systems by W. P. Dryer	
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3. The Cleaning of Fabricated Piping
by W. L. Sheets
4. Shops and Unusual Shop Duties
by W. L. Sheets and B. W. Whitehurst
5. Atomic Bomb Engineering
by A. C. Klein
6. Miles of Glass Piping
by B. W. Whitehurst

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STONE AND WEBSTER ENGINEERING CORPORATION CONTRIBUTION TO
THE ELECTROMAGNETIC SEPARATION PROJECT, PART II.
CHEMICAL ENGINEERING

Chief Editor: B. W. Whitehurst

Edited by: R. E. Argersinger, C. T. Chave, J. O'R. Coleman, R. L. Geddes,
and G. R. Strandberg

Unpublished Draft 10/14/1946 - Secret, declassified (unknown date)
USAEC Technical Information Service, Oak Ridge
502 pages

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VI	Introduction and Early History of the Chemical Facilities of the Electromagnetic Project by R. L. Geddes	
VII	Alpha Chemistry	
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	2. Engineering of the Alpha Plate Washing Areas by J. R. Chapman and A. Kirkpatrick	
	3. Bulk Treatment - Building 9202 by J. V. A. Longcor	
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	4. Reagents - Storage and Handling - Building 9207 Group by G. O. Neimeyer	
IX	Beta Chemistry	
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	2. The Engineering and Design of the Beta Plate Washing Areas by S. P. Bingham	
	3. Building 9211 - Beta Salvage by G. O. Neimeyer	

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1. The Application of Tantalum to Certain Unit Processes in the Purification and Recovery of Uranium Salts
by F. L. Hunter (Fansteel Metallurgical Corp.)
2. Electrical Precipitation Installation for the High Efficiency Recovery of UCl_5 Fume
by H. J. White (Research Corp.)

Report No.

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ISOTOPIC ANALYSIS

Edited by George M. Murphy and A. M. Wald

Published 1951 - Secret, declassified 8/1991
USAEC Technical Information Service, Oak Ridge
412 pages

Chapter		Report No.
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1	Mass-spectrometer Theory by M. G. Inghram and O. H. Nestor	
2	Apparatus by M. G. Inghram and O. H. Nestor	
3	Operational Characteristics by J. G. Heacock, M. G. Inghram, and O. H. Nestor	
4	Mass-spectrometer Operation by M. G. Inghram, O. H. Nestor, R. J. Omohundro, and G. Reed, Jr.	
5	Absolute Measurements by M. G. Inghram and B. M. Rustad	
6	Mass-spectrometer Maintenance by J. P. Chastagner, Jr., O. H. Nestor, D. Schuman, and J. L. Curlin	
7	Measurement of the Isotopic Enrichment of Uranium by the Dilution Method by Frank W. Hurd and A. B. Meservey	K-494
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8	Theory of the Counting Methods by B. Carroll	
9	Chemical Preparation of Uranium Samples for Counting Analysis by B. Carroll	
10	Procedures in Fission-counting Analysis by B. Carroll	
11	Film-fission Counter by Harold G. Beyer	
12	Counting Systems for Isotopic Analysis by H. D. Goldberg and M. I. Goldberg	
13	Uranium-isotope Determination by Alpha Measurement by M. L. Bello and R. I. Kiebanow	A-3247
14	Some Recent Developments in Counting Methods of Isotopic Analysis, Including Isotopic Standards and Determinations of Isotopic Content of Unaltered Uranium Edited by A. B. Meservey	K-115
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ENGINEERING DEVELOPMENTS IN THE GASEOUS DIFFUSION PROCESS

Edited by Manson Benedict and Clarke Williams

Published 1949

McGraw-Hill Book Company, Inc., New York

129 pages plus xx pages

Appendix C published 1946 - Secret, declassified 1/1956

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	Part 1 - Special Plant Instruments and Devices	
1	Recording Mass Spectrometer for Process Analysis by A. O. Nier, T. A. Abbott, and J. K. Pickard	MDDC-53
2	Recording Ionization Chamber for Traces of Radioactive Gases by A. O. Nier, C. M. Stevens, T. A. Abbott, and J. K. Pickard	MDDC-63
3	Magnetic Gear for Torque Transfer to a Closed System by T. A. Abbott and J. K. Pickard	MDDC-69
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8	Continuous Fluorine-disposal Plant by R. Landau	MDDC-153
9	The Reaction of Fluorine Oxide with Sodium Hydroxide by E. Simons, T. P. Wilson, and S. C. Schuman	MDDC-186
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Although no appendices appear in this volume, Appendix C appeared in a separate paper. We have found no evidence for the existence of Appendices A & B.

Appx. C.	Absorption of Fluorine and Uranium Hexafluoride by Sodium Carbonate Solutions by G. G. Joris, and C. D. Compton	AECD-3892
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THE THEORY OF ISOTOPE SEPARATION AS APPLIED TO THE LARGE-
SCALE PRODUCTION OF U²³⁵

By Karl P. Cohen

Edited by George M. Murphy

Main Report Number: MDDC-1138

Published 1951

McGraw-Hill Book Company, Inc., New York

165 pages plus xviii pages

Chapter		Report No.
1	Ideal Cascades	This volume is made up of Report MDDC-1138
2	Square Cascades	
3	Equilibrium Time of a Square Cascade	
4	Determination of Cascade Constants	
5	The Control Problem	
6	Centrifuges	
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SPECTROSCOPIC PROPERTIES OF URANIUM COMPOUNDS

By G. H. Dieke and A. B. F. Duncan

Main Report Number: MDDC-688

Published 1949

McGraw-Hill Book Company, Inc., New York

290 pages plus xviii pages

Chapter		Report No.
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1	Experimental Procedure	This volume is made up of Report MDDC-688
2	X-ray Analysis of the Crystal Structure of Uranyl Compounds	
3	General Features of the Fluorescence and Absorption Spectra of Uranyl Compounds	
4	Fluorescence Spectra of Uranyl Compounds	
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CHEMICAL SEPARATION OF THE URANIUM ISOTOPES

By Clyde A. Hutchinson, Jr.
Edited By George M. Murphy

Report Number: TID-5224
Published 1952 - Secret, declassified 3/1960
USAEC Technical Information Service, Oak Ridge
193 pages plus v pages

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1	Theory and General Discussion of the Chemical Separation of Isotopes
2	Experimental Details
3	Summary
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Report No.
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is made up
of Report
ANL-HDY-16

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PHYSICAL PROPERTIES AND ANALYSIS OF HEAVY WATER

By Isidor Kirshenbaum
Edited by Harold C. Urey and George M. Murphy

Published 1951
McGraw-Hill Book Company, Inc., New York
438 pages plus xv pages

Addendum Published 5/25/1951 - Secret, declassified, 3/1957
Report Number: TID-5028

Chapter		Report No.
1	Physical Properties	
2	Equilibrium Constants for Exchange Reactions	
3	Isotopic Analysis by the Mass Spectrometer	
4	Isotopic Analysis of Heavy Water by the Mass Spectrometer	
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6	Natural Abundance of the Hydrogen and Oxygen Isotopes	
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UTILIZATION OF HEAVY WATER

By Isidor Kirshenbaum

Edited by George M. Murphy and Harold C. Urey

Report Number: TID-5226

Published 1951 - Secret, declassified 4/1957

USAEC Technical Information Service, Oak Ridge

208 pages

Chapter

- 1 Introduction and Theory
 - 2 Properties of the Uranium Oxides
 - 3 Physical Properties of Slurries
 - 4 Reactions of the Uranium Oxides
 - 5 Stability of Construction Materials
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Report No.

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BIBLIOGRAPHY OF RESEARCH ON HEAVY HYDROGEN COMPOUNDS

Compiled by Alice H. Kimball

Edited by Harold C. Urey and Isidor Kirshenbaum

Main Report Number: AECD-1975

Published 1949

McGraw-Hill Book Company, Inc., New York

350 pages plus xv pages

Chapter

Introduction
Alphabetical Listing by Author
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Report No.
This volume
is made up
of Report
AECD-1975

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LABORATORY STUDIES FOR SEPARATION PROCESSES

By Maxwell L. Eidinoff, George G. Joris, Ellison H. Taylor, Hugh S. Taylor,
and Harold S. Urey

Edited by George M. Murphy, Harold C. Urey, and Isidor Kirshenbaum

Report Number: AECD-4238

Published 1951 - Secret, declassified 4/1957

USAEC Technical Information Service, Oak Ridge

406 pages

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1	Introduction by Harold C. Urey	
2	Distillation of Water by Maxwell L. Eidinoff	
3	Catalytic Exchange - General by Hugh S. Taylor	
4	Development of Nickel - Chromium Oxide as a Catalyst for Isotopic Exchange between Hydrogen and Water by Ellison H. Taylor	
5	Catalytic Exchange - Platinum and Palladium Catalysts by George G. Joris	
6	Hydrogen - Water - Vapor Exchange Glass Pilot Plant by Maxwell L. Eidinoff	
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By James O. Maloney and Harold S. Ray

Published 1951 - Secret, declassified 4/1960
USAEC Technical Information Service, Oak Ridge
220 pages

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2	Catalytic Exchange - Electrolyte Process for the Isolation of Heavy Water at Trail, B. C.	
3	Water-distillation Process for the Isolation of Heavy Water as Employed by E. I. du Pont de Nemours & Co., Inc., at Morgantown, W. Va.	
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PRODUCTION OF HEAVY WATER

Edited by George M. Murphy, Harold C. Urey, and Isidor Kirshenbaum

Published 1955

McGraw-Hill Book Company, Inc., New York

394 pages plus xvii pages

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Report No.

Part I - Commercial Production of Heavy Water

- 1 Introduction to Part I
- 2 Catalytic Exchange-Electrolytic Process for the Isolation of Heavy Water at Trail, B. C.
- 3 Water-distillation Process for the Isolation of Heavy Water As Employed by E. I. du Pont de Nemours & Co., Inc., at Morgantown, W. Va.
- 4 Hydrogen-distillation Process for the Isolation of Heavy Water
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by George G. Joris
 - 11 Hydrogen-Water Vapor Exchange Glass Pilot Plant
by Maxwell L. Eidinoff
 - 12 Dual-Temperature Process: Mercaptan-Water, Ammonia-Water-Hydrogen, and Cyclohexane-Benzene-Hydrogen Systems
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Edited by George M. Murphy

Report Number: TID-5227

Published 1952 - Secret, declassified 2/1957

USAEC Technical Information Service, Oak Ridge

485 pages

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Report No.

Part I - Isotope Separation

- 1 Selection of Method
- 2 Pilot-plant Experiments for Determination of the Fractionation Factor
- 3 Decomposition of the Ether Complexes
- 4 Stability of Construction Materials to the Dimethyl Ether Complex
- 5 Chemistry of Wet Complexes
- 6 Other Research and Development Necessitated by Plant Problems
- 7 Further Experiments on Exchange Reactions of Complex and Other Compounds of Boron

Part II - The Preparation of Elemental Boron

- 8 Conversion of Dimethyl Ether-Boron Trifluoride Complex to Boron Trichloride
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Edited by George M. Murphy and Samuel L. Madorsky

Published 1952 - Secret, declassified w/deletions (1951)
 USAEC Technical Information Service, Oak Ridge
 340 pages

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1	Concentration of U ²³⁵ by Countercurrent Molecular Distillation of Uranium Pentaethoxide and Uranium Pentapropoxide by Samuel L. Madorsky, A. Keith Brewer, T. I. Taylor, Steven Levinos, H. W. Bond, V. H. Dibeler, C. E. Wise, Jr., M. Swartz, and J. W. Westhaver	
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3	Molecular-distillation Method for the Separation of Uranium Isotopes by T. I. Taylor, J. K. Taylor, R. J. Britten, and Edgar R. Smith	M-4069
4	Concentration of U ²³⁵ by Countercurrent Electromigration by Samuel L. Madorsky, J. K. Taylor, V. H. Dibeler, and A. Keith Brewer	
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7	Concentration of Uranium Isotopes by Chemical Exchange by Steven Levinos	A3969
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THE EFFECT OF RADIATION ON WATER AND AQUEOUS SOLUTIONS OF
INORGANIC SUBSTANCES

By A. O. Allen

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29 pages

Chapter		Report No.
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METALLURGY OF URANIUM AND ITS ALLOYS

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THE ACTINIDE ELEMENTS

Edited by Glenn T. Seaborg and Joseph J. Katz

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THE TRANSURANIUM ELEMENTS: RESEARCH PAPERS

Edited by Glenn T. Seaborg, Joseph J. Katz, and Winston M. Manning

Published as 2 books (Part I & II) 1949
McGraw-Hill Book Company, Inc., New York
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Part II - pages 861-1733 plus xii pages

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PRODUCTION AND SEPARATION OF U²³³: SURVEY

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NNES - IV - 17B

PRODUCTION AND SEPARATION OF U^{233} : COLLECTED PAPERS

Edited by Leonard I. Katzin

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THE CHEMISTRY AND METALLURGY OF MISCELLANEOUS MATERIALS:
THERMODYNAMICS

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THE CHEMISTRY AND METALLURGY OF MISCELLANEOUS MATERIALS

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INDUSTRIAL MEDICINE OF THE PLUTONIUM PROJECT: SURVEY AND
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BIOLOGICAL EFFECTS OF EXTERNAL X AND GAMMA RADIATION: PART II

Edited by Raymond E. Zirkle

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Edited by Raymond E. Zirkle and Marjory Lawson

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METABOLISM AND BIOLOGICAL EFFECTS OF INTERNAL EMITTERS

Edited by Raymond E. Zirkle and M. Lawson

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HISTOPATHOLOGY OF IRRADIATION FROM EXTERNAL AND INTERNAL SOURCES

Edited by William Bloom

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TOXICOLOGY OF URANIUM: SURVEY AND COLLECTED PAPERS

Edited by Albert Tannenbaum

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 333 pages plus xxvi pages

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2	Nature of Uranium Poisoning as Observed in Mice by Albert Tannenbaum and Herbert Silverstone	AECD-1993-B
3	Factors Affecting Uranium Poisoning by Albert Tannenbaum and Herbert Silverstone	AECD-1993-C
4	Distribution in Tissues and Excretion of Uranium by Albert Tannenbaum and Herbert Silverstone	AECD-1993-D
5	Gross and Microscopic Pathology of Uranium Poisoning by Albert Tannenbaum	AECD-1993-E
6	Biochemical Effects of Uranium Poisoning by Samuel Schwartz	AECD-1993-F
7	The Mechanism of Action of Uranium and the Transport of Uranium to the Tissues by E. S. Guzman Barron	AECD-1993-G
8	Summary of Experimental Studies. Relation to Uranium Poisoning in Man by Albert Tannenbaum and Herbert Silverstone	AECD-1993-H
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5	Relation of Uranium Excretion to the Total Amount of Uranium in the Mouse by Albert Tannenbaum and Herbert Silverstone	MDDC-698 CH-3616
6	Studies on Acquired Tolerance to Uranium by Albert Tannenbaum and Herbert Silverstone	MDDC-825 CH-3641

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Paper		Report No.
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8	Tracer Studies of the Distribution and Excretion of Uranium in Mice, Rats, and Dogs by Albert Tannenbaum, Herbert Silverstone and Janet Koziol	AECD-2167 CH-3659
9	The Transport of Uranium to the Tissues by John A. Muntz and E. S. Guzman Barron	MDDC-760 CH-3708
10	Tissue Metabolism of Rats Treated with Uranyl Nitrate by Joe Meyer, John A. Muntz, Thomas P. Singer, and E. S. Guzman Barron	MDDC-757 CH-3710
11	The Reversible Inhibition of Enzymes by Uranium by Thomas P. Singer, John A. Muntz, Joe Meyer, Betty Gasvoda, and E. S. Guzman Barron	AECD-2021 CH-3739
12	Effect of Uranium on the Metabolism of Yeast and Bacteria by John A. Muntz, Thomas P. Singer, and E. S. Guzman Barron	MDDC-759 CH-3716
13	An Introduction to the Nonclassified Literature Dealing with Biochemical Studies of Experimental Uranium Poisoning by Samuel Schwartz and Elaine J. Katz	CH-3712
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ELECTRONICS: EXPERIMENTAL TECHNIQUES
(Los Alamos Technical Series - Volume I, Part I)

Edited by William C. Elmore and Matthew Sands

Published 1949

McGraw-Hill Book Company, Inc., New York
417 pages plus xviii pages

Chapter		Report No.
1	Circuit Components and Construction Practice By William C. Elmore	AECD-2208-A
2	Circuit Elements by William C. Elmore and Matthew Sands	AECD-2208-B
3	Voltage Amplifiers by William C. Elmore	AECD-2208-C
4	Electronic Counters by Matthew Sands and William C. Elmore	AECD-2208-D
5	Oscillographs and Associated Equipment by William C. Elmore	AECD-2208-E
6	Test and Calibration Equipment by William C. Elmore	AECD-2208-F
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IONIZATION CHAMBERS AND COUNTERS: EXPERIMENTAL TECHNIQUES
(Los Alamos Technical Series - Volume I, Part II)

Edited by Bruno B. Rossi and Hans H. Staub

Published 1949

McGraw-Hill Book Company, Inc., New York

243 pages plus xviii pages

Chapter		Report No.
1	Behavior of Free Electrons and Ions in Gases	MDDC-1016
2	Operation of Ionization Chambers with Constant Ionization	MDDC-1016
3	Operation of Ionization Chambers with Variable Ionization	MDDC-1016
4	Gas Multiplication	MDDC-1016
5	Beta-ray, Gamma-ray, and X-ray Detectors	MDDC-1016
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ALAMOS PROJECT

(Los Alamos Technical Series - Volume I, Part III)

Edited by Alvin C. Graves and Darol K. Froman

Published 1952

McGraw-Hill Book Company, Inc., New York

323 pages plus xiii pages

Chapter		Report No.
1	Preparation of Foils by R. W. Dodson, Alvin C. Graves, L. Helmholz, D. L. Hufford, R. M. Potter, and J. G. Povelites	LADC-515
2	Neutron Sources by Alvin C. Graves, R. L. Walker, R. F. Taschek, A. O. Hanson, J. H. Williams, and H. M. Agnew	LADC-515
3	The Modulated Betatron by Donald Kerst	AECD-2287
4	Modulation and Other Techniques Used with Ion Accelerators by B. D. McDaniel, Leo S. Lavatelli, and Elizabeth Graves	AECD-2287
5	Topics on Vacuum Technique by Thoma Snyder and David Lipkin	LADC-517
6	Optical Methods and Instruments by J. E. Mack	LADC-517
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INTRODUCTION TO THE THEORY OF NEUTRON DIFFUSION
(Los Alamos Technical Series - Volume IV)

Edited by K. M. Case, F. de Hoffmann, and G. Placzek

Published 1953
Los Alamos Scientific Laboratory, Los Alamos, NM
174 pages plus viii pages

Section		Report No.
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2	Continuity Equation	
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9	Remarks on the Reciprocity Theorem	
10	Escape Probabilities	
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18	Standard Problems	
	18.1 Source-Free Half-Space	
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Volume II is expected to contain the following sections
(Probably Never Published)

18	Standard Problems (continued)
	18.2 Half Space with Sources
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	18.5 Spheres and Cylinders Surrounded by Purely Scattering Medium
19	Application of Standard Problems
	19.1 Critical Problems
	19.2 Albedo Problems
	19.3 Utilization Problems

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PHARMACOLOGY AND TOXICOLOGY OF URANIUM COMPOUNDS

Edited by Carl Voegtlin and Harold C. Hodge

Published as 4 books - 1949 (books 1&2) and 1953 (books 3&4)

McGraw-Hill Book Company, Inc., New York

Book 1 - pages 1-524 plus xvii pages

Book 2 - pages 525-1084

Book 3 - pages 1087-1778 plus xviii pages

Book 4 - pages 1779-2466 plus vi pages

Chapter	Report No.
Historical Forward by Harold C. Hodge	MDDC-322
Introduction by Harold C. Hodge	MDDC-323

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1	The Chemistry of Uranium Compounds by Alexander L. Dounce and John F. Flagg	MDDC-422
2	Analytical Methods for Determining Uranium and Fluorine by John F. Flagg	MDDC-321
3	Statistical Methods by D. V. Tiedeman, L. S. Kegan, and M. J. Wantman	MDDC-332
4	Pathological Anatomy Following Uranium Poisoning by Thomas B. Barnett and Roger G. Metcalf	MDDC-249
5	Characteristics of Uranium Poisoning by J. Henry Wills	MDDC-271
6	Toxicity Following Parenteral Administration of Certain Soluble Uranium Salts by Frances Haven and Harold C. Hodge	MDDC-258
7	Studies of Toxicity of Various Uranium Compounds When Fed to Experimental Animals by Elliott A. Maynard and Harold C. Hodge	MDDC-263
8	The Toxicology of Compounds of Uranium Following Application to the Skin by James A. Orcutt	MDDC-266
9	The Toxicology of Uranium Compounds Following Application to the Eye by James A. Orcutt	MDDC-265
10	Toxicity Following Inhalation by H. E. Stokinger, A. Rothstein, E. Roberts, C. J. Spiegl, H. P. Dygert, C. W. LaBelle, and G. F. Sprague, Jr.	MDDC-376
11	The Distribution and Excretion of Uranium by William F. Neuman	MDDC-264
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20	Oral Toxicity of Uranium Compounds by Elliott A. Maynard, William L. Downs, and Harold C. Hodge	
21	Toxicity Following Inhalation for 1 and 2 Years by H. E. Stokinger, R. C. Baxter, H. P. Dygert, C. W. LaBelle, S. Laskin, U. C. Pozzani, E. Roberts, J. J. Rothermel, A. Rothstein, C. J. Spiegl, G. F. Sprague III, H. B. Wilson, and R. G. Yaeger	
22	Insufflation Studies in Rabbits with Dusts of Uranium Compounds by Herbert E. Thompson and Luville T. Steadman	

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24	Deposition of Uranium in Bone by William F. Neuman	
25	Studies in Cell Metabolism by Aser Rothstein	
26	Maximum Allowable Concentration of Uranium Dust in Air by H. C. Hodge, H. E. Stokinger, W. F. Neuman, W. F. Bale, and A. E. Brandt	
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BIOLOGICAL EFFECTS OF EXTERNAL RADIATION

Edited by H. A. Blair

Published 1954

McGraw-Hill Book Company, Inc., New York

508 pages plus xvii pages

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by Robert D. Boche and Francis W. Bishop
- 2 Pathological Changes Exhibited by Animals Exposed to Single Doses of X Radiation
by Roger G. Metcalf, Richard J. Blandau, and Thomas B. Barnett
- 3 Effects of Acute Exposure to X Radiation on the Peripheral Blood of Experimental Animals
by M. Ingram and W. B. Manson
- 4 Callicrein and Radiation
by Kathryn F. Fink
- 5 Cross-circulation Experiments
by John S. Lawrence and William N. Valentine
- 6 Finger Ridge Changes in Monkeys Following X Radiation
by Roger A. Harvey
- 7 Experiments on the Validity of the Linear Relation of Mutation Frequency to X-ray Dose in *Drosophila melanogaster*
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- 10 Effects of Chronic Exposure to X Radiation on Growth and Survival
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- 11 Effects of Chronic Exposure to X Radiation on the Peripheral Blood of Experimental Animals
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BIOLOGICAL STUDIES WITH POLONIUM, RADIUM, AND PLUTONIUM

Edited by Robert M. Fink

Published 1950

McGraw-Hill Book Company, Inc., New York

411 pages plus xvi pages

Chapter		Report No.
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3	Studies of Polonium Metabolism in Human Subjects	AECD-2591
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PREPARATION, PROPERTIES, AND TECHNOLOGY OF FLUORINE AND
ORGANIC FLUORO COMPOUNDS

Edited by Charles Slesser; Associate Editor, Stuart R. Schram

Published 1951

McGraw-Hill Book Company, Inc., New York

868 pages plus xxiii pages

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15	Preparation of Polychloro-bis(trichloromethyl)benzenes by E. T. McBee, H. B. Hass, P. E. Weimer, W. E. Burt, Z. D. Welch, R. M. Robb, and F. Speyer	MDDC-220
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URANIUM TECHNOLOGY: GENERAL SURVEY

By J. E. Vance and J. C. Warner

Edited by L. G. Bassett and A. M. Wald

Report Number: TID-5231

Published 1951 - Secret, declassified, 7/1960

USAEC Technical Information Service, Oak Ridge

238 pages

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2	Extraction of Uranium from Pitchblende and Torbernite Ores by the Sulfuric Acid Process by J. E. Vance	
3	Preparation of Pure U_3O_8 from Crude U_3O_8 and from Sodium Diuranate by J. E. Vance	
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POLONIUM

Edited by Harvey V. Moyer

Report Number: TID-5221

Published 1956

USAEC Technical Information Service, Oak Ridge

392 pages plus x pages

POLONIUM, CHAPTER 14, THE PRODUCTION OF POLONIUM

by J. W. Wright and G. D. Nelson

Report Number: TID-5316

Published 1955 - Secret, declassified 1960

69 pages

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7	Polonium from Irradiated Bismuth: Chemical Separation by Lloyd B. Gnagey, James M. Goode, G. D. Nelson, and J. W. Wright	
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13	Health Physics by Warren L. Hood and John S. Stanton	

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14	Polonium. Chapter 14. The Production of Polonium by J. W. Wright and G. D. Nelson
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TID-5316

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THE METALLURGY OF ZIRCONIUM
(Title on Cover: METALLURGY OF ZIRCONIUM)

Edited by Benjamin Lustman and Frank Kerze, Jr.

Published 1955
McGraw-Hill Book Company, Inc., New York
776 pages plus xviii pages

Chapter		Report No.
1	Zirconium and Its Application to Nuclear Reactors by H. Etherington, R. C. Dazell, and D. W. Lillie	
2	Application of Zirconium for Other Uses by R. I. Jaffee	
3	Occurrence of Zirconium by M. H. Kline	
4	Zirconium Production Methods by S. M. Shelton	
5	Iodide-Decomposition Process for Production of Zirconium by Z. M. Shapiro	
6	Melting and Shaping of Zirconium and Its Alloys by R. B. Gordon	
7	Joining and Finishing of Zirconium	
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11	Corrosion of Zirconium and Its Alloys Edited by Benjamin Lustman	
12	Analytical Chemistry of Zirconium by E. B. Read	
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Appx. B	Industrial Hygiene and Safety by E. E. Barnes	
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ANALYTICAL CHEMISTRY OF THE MANHATTAN PROJECT

Edited by C. J. Rodden, N. H. Furman, E. H. Huffman, T. D. Price,
L. L. Quill and J. I. Watters

Published 1950
McGraw-Hill Book Company, Inc., New York
748 pages plus xx pages

Chapter 41
Published 4/1946 - Secret, declassified
23 pages

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1	Uranium by C. J. Rodden and J. C. Warf	
2	Thorium by C. J. Rodden and J. C. Warf	AECD-2701
3	Nitrogen by K. J. Jensen and R. J. Mundy	MDDC-572
4	Silicon by K. J. Jensen and C. J. Rodden	MDDC-1373
5	Fluorine and Fluorocarbons by G. W. Busch, R. C. Carter, F. E. McKenna, H. R. Priest, and E. Staple	AECD-2604
6	Carbon, Hydrogen, and Oxygen by C. J. Rodden	MDDC-581
7	Chlorine, Bromine, and Iodine by R. G. Mansfield and D. H. Templeton	AECD-2607
8	Sulfur, Selenium and Tellurium by F. E. McKenna and D. H. Templeton	MDDC-1379
9	Phosphorous, Arsenic, Antimony, and Bismuth by D. H. Templeton and L. G. Bassett	MDDC-1389
10	Sodium, Potassium, Rubidium, and Cesium by L. G. Bassett and W. Byerley	MDDC-1132
11	Beryllium, Magnesium, Calcium, Strontium, Barium, and Radium by L. W. Neidrach, A. M. Mitchell, and C. J. Rodden	AECD-2159
12	Germanium, Tin, and Lead by R. E. Telford and N. H. Furman	AECD-2612
13	Aluminum, Gallium, Indium, and Thallium by L. G. Bassett and F. S. Tomkins	AECD-2599
14	Zinc, Cadmium, and Mercury by N. H. Furman and K. J. Jensen	MDDC-755
15	Copper, Silver, and Gold by T. D. Price and R. E. Telford	MDDC-372

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18	Chromium, Molybdenum, and Tungsten by K. J. Jensen and B. Weaver	MDDC-492
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THE CHEMISTRY OF URANIUM. PART I. THE ELEMENT, ITS BINARY AND RELATED COMPOUNDS

By Joseph J. Katz and Eugene Rabinowitch

Published 1951

McGraw-Hill Book Company, Inc., New York
609 pages plus xxi pages

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2	Properties of the Uranium Atom	AECD-2624
3	Uranium in Nature	AECD-2624
	Part 2 - Uranium Metal	
4	Extraction of Uranium from Ores and Preparation of Uranium Metal	AECD-2624
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CHEMISTRY OF URANIUM: COLLECTED PAPERS

Edited by Joseph J. Katz and Eugene Rabinowitch

Report Number: TID-5290

Published 1958 in 2 books

USAEC Technical Information Service, Oak Ridge

769 pages plus xv pages

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Book 2 - Papers 50-81

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2	Some Reactions of Uranium Metal by J. C. Warf	
3	X-ray Investigation of the Uranium-Hydrogen System: The Structure of UH_3 by R. E. Rundle, A. S. Wilson, and R. A. McDonald	
4	Reduction of Uranium Hexafluoride to Uranium Tetrafluoride by I. B. Johns, A. D. Tevebaugh, E. Gladrow, K. Walsh, P. Chiotti, B. Ayers, F. Vaslow, and R. W. Fisher	
5	Conversion of UF_4 to U_3O_8 by A. D. Tevebaugh, R. D. Tevebaugh, W. D. Cline, and J. C. Warf	
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by Albert L. Myerson and John H. Eicher
- 62 The Intermediate Uranium Fluoride Compounds α -UF₅, β -UF₅,
U₂F₉, and U₄F₁₇
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by Edward P. Ney and Fontaine C. Armistead
- 64 Reaction of Uranium Sulfates with Sodium Hydroxide
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- 71 Thermal Conductivity of Liquid UF₆
by Homer F. Priest
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by Homer F. Priest and G. L. Priest
- 73 Measurement of the Density of Liquid UF₆
by Homer F. Priest and G. L. Priest
- 74 The Vapor Pressure of Uranium Hexafluoride in Equilibrium with
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by H. F. Priest

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MEDICAL EFFECTS OF THE ATOMIC BOMB IN JAPAN

Edited by Ashley W. Oughterson and Shields Warren

Published 1956

McGraw-Hill Book Company, Inc., New York

477 pages plus xvi pages

Chapter		Report No.
1	Summary	
2	Prelude to Medical Investigation	
3	Scope of Damage and the Effects on Medical Care and Facilities	
4	Number and Types of Casualties	
5	Clinical Observations in Hiroshima and Nagasaki	
6	Hematology of Atomic-bomb Injuries	
7	Pathology of Atomic-bomb Injuries	
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LIQUID THERMAL DIFFUSION

Report Number: TID-5229

Edited by Philip H. Abelson, Nathan Rosen, and John I. Hoover

Published 1951 - Secret, declassified, 6/1957

USAEC Technical Information Service, Oak Ridge

176 pages plus 4 pages

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Report No.

Part I - General Theory and Project History

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| 1 | A Survey of the Literature Relevant to Liquid Thermal Diffusion |
| 2 | Early History of the Liquid Thermal Diffusion Project |

Part II - Theoretical Aspects

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| 3 | The Column |
| 4 | Approach to Equilibrium by a Single Column |
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| 8 | Columns in a Pyramid |
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DEVELOPMENTS IN THE CENTRIFUGE SEPARATION PROJECT

Report Number: TID-5230

By J. W. Beams, A. C. Hagg, and E. V. Murphee

Edited by A. M. Wald

Published 1951 - Secret, declassified, 11/1959

USAEC Technical Information Service, Oak Ridge

260 pages

Chapter

Report No.

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- 1 Evaporative-centrifuge Method
- 2 Flow-through or Concurrent Method of Centrifuging
- 3 Countercurrent-flow Method Applied to H₂-CO₂ Mixtures
- 4 Uranium-isotope Separation by Countercurrent Refluxing Using
32-inch Tubular Centrifuge
- 5 Uranium-isotope Separation by Countercurrent Refluxing Using
136-inch Tubular Centrifuge

Part II - The Westinghouse Gas Separators

- 6 The 42-inch Gas Separator
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- 8 Separation Theory
 - 9 Process Design of Centrifuge
 - 10 Pilot-plant Operation of Gas Centrifuge
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- Appx. A Continuous Measurement of Isotopes Concentration
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June 4, 1999

Distribution:

Re: Transmittal of Report SAND99-1114, "The National Nuclear Energy Series: An Abridged Compilation"

Enclosed is a copy of the subject report prepared by Nancy Orlando-Gay, James Brangan, and Jonathan Wise of Sandia National Laboratories. This report summarized the current status of the National Nuclear Energy Series, which is a 1950's era technical history of the scientific and engineering advances made as part of the Manhattan project.

This report was prepared under the auspices of the Nuclear Transfer and Supplier Policy Division (NN-43) of the Department of Energy, Ms. Trisha Dedik, Director. Comments or questions regarding this report are welcome and may be directed to James Brangan at (505)-844-1832 or to Jonathan Wise at (505)-844-8547.

Sincerely,

A handwritten signature in cursive script that reads "Randall K. King".

Randall K. King
Export Control Program Manager

Enclosure: As stated



